

Scope of Work: Bioassays to Investigate Nutrient Limitation in Utah Lake

1 Introduction

The Utah Department of Environmental Quality, Division of Water Quality (DWQ) is requesting grant proposals for technical support to conduct bioassay nutrient limitation studies on Utah Lake. Bioassay experimentation was prioritized for 2019 by the Utah Lake Water Quality Study (ULWQS) Science Panel to determine spatial and temporal nutrient limitation in the lake. The target completion date of the work is June 30, 2020.

Please submit a grant proposal including a cost proposal to Emily Canton at ercanton@utah.gov by 5:00 PM MST May 22, 2019. Proposals must be limited to 10 pages; this page limit does not include resumes and project case studies that may be included in an appendix.

2 Background

DWQ recently initiated Phase 2 of the Utah Lake Water Quality Study (ULWQS) to evaluate the effect of excess nutrients on the lake's recreational, aquatic life, and agricultural designated uses and to develop site-specific nitrogen and phosphorus water quality criteria to protect these uses. The ULWQS is guided by the Stakeholder Process (Attachment A) developed during Phase 1, which established a 16-member interest-based Steering Committee and a 10-member disciplinary-based Science Panel. The Steering Committee has charged the Science Panel with developing and answering key questions to characterize historic, current, and future nutrient conditions in Utah Lake (Attachment B). Responses to the key questions will be used by the Steering Committee to establish management goals for the lake and by the Science Panel to guide development of nutrient criteria to support those goals.

Additionally, the Science Panel must complete a significant number of tasks to achieve its purpose of guiding the development of nutrient criteria including:

- Guiding the approach for establishing nutrient criteria
- Recommending and guiding studies to fill data gaps needed to answer key questions
- Interpreting and integrating study results into the rationale for nutrient criteria
- Guiding development of an approach for characterizing uncertainty
- Recommending science-based nutrient criteria to the Steering Committee

Problem Statement

Understanding which nutrients limit primary production in Utah Lake will help describe the current state of the lake with respect to nutrients, trophic state, and ecology. Some shallow lake systems transition from phosphorus limitation early in the growing season to nitrogen limitation later in the season, which can provide an opportunity for late-season cyanobacterial dominance (due to their nitrogen-fixing capabilities). In other lakes, non-nitrogen fixers can dominate throughout the bloom season, or nitrogen-fixing species may increase but may not be actively fixing nitrogen. Little is known about nutrient limitation in Utah Lake, including which nutrients are limiting, and whether there are seasonal and spatial dynamics in nutrient limitation.

Existing Data and Information (see also Attachment C)

The Phase 1 report characterizes in-lake nutrient conditions and describes general linkages among trophic indicators, including nutrients. In the Phase 1 data analysis, chlorophyll-*a* and total phosphorus concentrations varied by site, with the highest concentrations in Provo Bay (Attachment D: Utah Lake Water Quality Study, Phase 1 report). Seasonal patterns in chlorophyll-*a* were observed, with peak algal growth in August through October. There were no clear seasonal patterns in total phosphorus or Secchi depth transparency (<https://udwq.shinyapps.io/UtahLakeDataExplorer/>).

Study Objectives

The objective of this research is to address the following question identified by the Science Panel as critical to understanding the current state of Utah Lake with respect to nutrients and ecology: Which nutrients are actually controlling primary production and HABs and when? (Science Panel charge 2.3.ii, Attachment B). The study is designed to address the following topics:

- Determine the nutrient limitation dynamics of Utah Lake (regarding phosphorus (P)-, nitrogen (N)-, or co-P and N limitation)
- Determine whether there is a seasonal dynamic to the above (i.e., P limitation leading to N limitation)
- Determine whether there is a spatial dynamic to the above (i.e., 3 sites—Provo Bay; main body of lake, east; main body of lake, west)

This study will provide baseline information on nutrient limitation in Utah Lake via bioassay experiments. The data may serve to inform a follow-up project investigating nutrient limitation in more detail.

Expected Outputs and Outcomes

When this study is completed, the Science Panel will be able to answer the study objectives listed above.

Specific outputs are expected to include, but are not limited to, a sampling and analysis plan (SAP), the project dataset from bioassay experiments, and a technical report. All data collected for this project must be made available to the Science Panel per the deliverable dates schedule in Section 6 of this RFP.

3 Supporting Materials

A number of reports and documents were developed during the course of the ULWQS and previous study efforts on Utah Lake. These documents are provided as attachments for reference during response development. Additional ULWQS information including data, reports, meeting summaries, meeting recordings, and other related materials are available at utahlake.deq.utah.gov. A list and brief description of the relevant materials is included here:

- Attachment A. Stakeholder Process <https://documents.deq.utah.gov/water-quality/watershed-protection/utah-lake/DWQ-2017-004494.pdf>. This document prescribes the structure, objectives, and duties of the Steering Committee, Science Panel, and other organizations with a role in the ULWQS. This process is directed by an independent professional facilitation team.
- Attachment B. ULWQS Phase 2 Purpose and Initial Charge to Science Panel from Steering Committee. This document describes the Initial High Level Charge questions developed by the Steering Committee and an initial list of key questions designed to answer each high level charge <https://documents.deq.utah.gov/water-quality/locations/utah-lake/DWQ-2019-001842.pdf>.
- Attachment C. Utah Lake Literature Review – This literature review was developed as a Phase 1 task and assessed the ability of existing literature and studies to answer the Initial High Level Charge questions presented in the ULWQS Phase 2 Initial Charge document. See select references in the Utah Lake Literature Review under *Topical Category 1: In-Lake Water Quality Conditions* for a list and findings of references relevant to historical conditions in Utah Lake. <https://documents.deq.utah.gov/water-quality/locations/utah-lake/DWQ-2019-001842.pdf>
- Attachment D. ULWQS Phase 1 Report – This report was developed by DWQ to fulfill the work elements of the Phase 1 work plan including stakeholder development, data compilation and management, beneficial use assessment, loading characterization, and model development. <https://documents.deq.utah.gov/water-quality/locations/utah-lake/DWQ-2019-001841.pdf>
- Attachment E. Quality Assurance Program Plan for Environmental Data Operations, Final Plan, Revision No. 1.0, Effective September 5, 2014. <https://deq.utah.gov/water-quality/quality-assurance-and-quality-control-program-monitoring-water-quality>

4 Project Tasks

DWQ is seeking a qualified entity to provide technical support to the ULWQS Science Panel to assist with collecting information on nutrient limitation in Utah Lake. The tasks within this scope of work reflect a recommended approach for this work and are designed to help the proposer meet the study objectives and expected outputs and outcomes, which support the Science Panel in accomplishing its duties and fulfilling the Steering Committee's Charge (Attachment B). Proposers should feel free to include additional tasks in the proposals as they see appropriate to best achieve the study objectives and expected outcomes.

The deliverables for tasks presented in this Scope of Work will be reviewed collaboratively with the ULWQS Science Panel. The selected contractor will work closely with the Science Panel to perform each task and is expected to be responsive to input and guidance provided by the Panel. If, during the course

of the project, there are deviations from the project tasks as described here, the selected contractor should contact DWQ and the Science Panel and come up with a mutually agreed upon course of action.

Task 1. *Develop sampling and analysis plan (SAP)*

A sampling and analysis plan (SAP) will be developed in accordance with the Utah DWQ's *Quality Assurance Program Plan for Environmental Data Operations, Final Plan* (Revision No. 1.0, see Attachment E). The essential elements for SAPs are listed in Appendix A of the *Quality Assurance Program Plan* and are as follows:

1. Introduction and background information
2. Objectives and design of the investigation
3. Special precautions and safety plan
4. Field sampling methods and documentation
5. Laboratory sample handling procedures
6. Analytical methods and laboratory documentation
7. Project quality control requirements
8. Data analysis, record keeping, and reporting requirements
9. Schedule and budget
10. Project team and responsibilities

Expected Deliverables

- Draft and final sampling and analysis plans in accordance with the Utah DWQ's *Quality Assurance Program Plan for Environmental Data Operations, Final Plan*.

Proposal Elements

Responses should:

- Provide demonstrated experience with developing sampling and analysis plans.
- Discuss a proposed approach for developing the deliverable for this task.

Task 2. *Conduct bioassay experiments*

Bioassay experiments will be conducted three times: mid-summer (2019), early fall (2019), and spring bloom (2020). The experiments should adhere to the following:

- 1-gallon cubitainers (16 cubitainers per experiment)
- Three replicates and four treatments (control, N, P, N+P); after protocols are established and results are shown to be reproducible, two replicates may be used.
 - Control: lake water at time of sampling
 - N+P treatment: N:P 16:1 (molar)
 - P concentration for P and N+P amendments: 0.1 mg/L
 - Amend all bioassays with bicarbonate to avoid carbon limitation

- Collect lake water, homogenize into a 55-gallon drum, then pour back into cubitainers.
- Deployments will take place over the course of the growing season: one deployment to examine spring bloom, one in mid-summer, and one in the early fall. Because the timing of this project will not allow a deployment during the spring bloom of 2019, the spring bloom deployment will occur in 2020.
- Place into PVC corrals with nets. To facilitate experimental set-up, experiments may be performed within a sheltered, easy-access location (e.g., marina) that has light levels and temperatures similar to the water collection sites.
- 24, 48, and 72-hour endpoints: Use these endpoints in the first experiment to determine the rate of increase in biomass in the nutrient amendments vs. controls. Fine-tuning of the endpoints may be needed for the remaining experiments.
- Measure chlorophyll-*a*, species composition (biovolume), phosphorus and nitrogen fractions (TP, TN, NH₄-N, NO_x-N, soluble reactive phosphorus), HPLC for pigments, toxins (suggested to use ELISA kit approach). Measure dissolved oxygen and pH of cubitainers immediately after opening.
- Conduct the above at 3 sites in Utah Lake, ranging in trophic state and nutrient delivery— Provo Bay; main body of lake, east; main body of lake, west.

Expected Deliverables

- Electronic files with field observations and laboratory results

Proposal Elements

Responses should:

- Provide demonstrated experience with conducting nutrient bioassays.
- Discuss a proposed approach for conducting the bioassay experiments.

Task 3. *Prepare technical report*

The technical report will describe primary productivity limitation in Utah Lake, seasonally and spatially. The report must include the methods, results, and discussion that answers the study objectives.

Expected Deliverables

- Draft and final technical reports.

Proposal Elements

Responses should:

- Provide demonstrated experience with developing technical reports of this nature.
- Discuss a proposed approach for developing the deliverable for this task.

5 Key Personnel

Grant proposals should discuss in detail the team members proposed for each task, their directly related experience and expertise, and the allocation of effort among team members. Responses must detail the allocation of proposed hours for each task and team member in the table below. Please also include team members and time allocation for project management, project support such as technical editing and GIS, and other allocations not directly associated with the tasks and deliverables presented in this scope.

Task #	Deliverable	Team Member (hours)	Team Member (hours)	Team Member (hours)	Team Member (hours)
1	Deliverable 1				
	Deliverable 2				

6 Deliverables and Preliminary Due Dates

Deliverable due dates are based upon days from the contract award date. The project and all deliverables must be completed with consideration of the milestones in the table below, the scope of work response, and the final work plan after scope award. Any change in the execution date of the contract must result in a mutually agreed upon change in deliverable dates. All final products generated by the contractor will be transmitted to DWQ in a mutually agreed upon format prior to the expiration of the contract.

Task	Deliverable	Due Date
Task 1 – Develop Sampling and Analysis Plan	Draft sampling and analysis plan (SAP) Final SAP	14 days after scope award 30 days after scope award
Task 2 – Conduct Bioassay Experiments	Electronic files with field observations and laboratory results	45 days after each deployment
Task 3 – Prepare Technical Report	Draft technical report Final technical report	June 12, 2020 June 30, 2020

7 Science Panel Collaboration and Data Sharing

Grant recipients are required to complete this scope of work in collaboration with the ULWQS Science Panel. Grant recipients will:

- Develop the final research work plan in consultation with the Science Panel;
- Be responsive to Science Panel input on the final approach, work plan, work plan execution deliverables, results, analysis, final report, and any other interest to the Science Panel;
- Make all data and information collected by this grant, or funded by the ULWQS, available to the Science Panel within 45 days of each bioassay deployment;

8 Evaluation and Award

Offers will be evaluated based on the following criteria listed in relative order of importance:

Selection Criteria	Weight
Key Personnel proposed for project work (experience, expertise, and reliability) and experience of specific team members proposed for discrete tasks	20%
Method of approach and proposer's ability to perform the requirements of the grant	20%
Demonstrated understanding of work elements in the context of existing products, the Utah Lake ecosystem, and the Science Panel Initial Charge	20%
Proposed approach for Science Panel collaboration and data sharing	20%
Price	20%

9 Cost Proposal Form

Offers must include a cost proposal utilizing the format provided below. Please ensure the cost proposal can be removed from the proposal for independent evaluation by including it as an attachment to the proposal or as a separate section at the end of the proposal. Note that indirect costs may not exceed 10% on contracts with other state and local governmental agencies, including colleges and universities.

Task #	Deliverable	Proposed Cost (USD)
Total		

10 Instructions for Grant Proposal Preparation

Proposals must include the following elements to qualify:

- 1) Proposals must follow the proposal template presented in Section 11
- 2) Proposals must:
 - a. Include a discussion of successfully completed projects relevant to the specific deliverables in this scope of work;
 - b. Demonstrate that proposed team members have direct experience with and are qualified for conducting the specific tasks and deliverables for which they are proposed. Team member qualifications and resumes must be included as an appendix to the proposal. Resumes will not be counted against the proposal page limit;
 - c. Specify all project roles for the proposed team members including, but not limited to, project management, analytical tasks, GIS, technical editing, and any other proposed roles;
- 3) Proposed approach for how each task will be performed to achieve the purpose and deliverables outlined in this Scope of Work. Applicants may propose supplemental work elements necessary to achieve the expected outputs and outcomes;
- 4) Schedule for key milestones and deliverables;
- 5) A table of estimated level of effort for each team member by task utilizing the provided template (in Section 5); and
- 6) A stand-alone cost proposal table utilizing the provided template (Section 9) to include key personnel rates, hours and rates for completing specific tasks and deliverables, total proposed hours, indirect costs, overhead, and total cost.

11 Proposal Template

1. Experience and Expertise
 - 1.1. Related project experience
 - 1.2. Experience and expertise of key personnel
2. Proposed Approach
 - 2.1. Task 1 (repeat for each task)
 - 2.1.1. Key team members
 - 2.1.2. Approach discussion
 - 2.1.2.1. Approach for required Scope of Work deliverables
 - 2.1.2.2. Supplemental approach
 - 2.1.2.3. Task milestones and deliverables
3. Approach for Science Panel Collaboration and Data Sharing
4. Project milestones and deliverables
 - 4.1. A table of project milestones and deliverables
5. Level of effort
 - 5.1. A table with level of effort estimates
6. Cost Proposal
 - 6.1. A stand alone cost proposal table
7. Resumes (not counted toward page limit)
8. Related Case Study (not counted toward page limit)

12 Notice to Proceed

Notice to proceed will be provided by DWQ after receiving a signed grant agreement and Science Panel approval on the final work.